Invacare® ***Electra***

Scooter

Service Manual

CE

INVACARE®

How to get in touch with *INVACARE®*

If you have any questions, or need help, you can reach us using the following addresses and telephone numbers within Europe:

Invacare® Deutschland GmbH
Dehmer Str. 66
D-32549 Bad Oeynhausen
Deutschland
☎ (Kundendienst): +49 - (0) 5731 - 754 580
☎ (Technische Hotline): +49 - (0) 5731 - 754 570
Fax (Kundendienst): +49 - (0) 5731 - 754 216
Fax (Technische Hotline):+49 - (0) 5731 - 754 208

Invacare® A/S
Sdr. Ringvej 39
2605 Brøndby
Danmark
☎ (Kundeservice): +45 - (0) 3690 0000
Fax (Kundeservice): +45 - (0) 3690 0001

Invacare®, SA
c/ Areny, s/n
Poligon Industrial de Celrà
17460 Celrà (Girona)
ESPAÑA
☎ : +34 - (0) 972 - 49 32 00
Fax: +34 - (0) 972 - 49 32 20

Invacare® POIRIER
Les Roches
F-37230 Fondettes
France
☎ (Service Après-Vente):+33 - (0) 2 47 - 62 64 15
Fax (Service Après-Vente) :+33 - (0) 2 47 - 62 64 64

Invacare® Ltd
South Road
Bridgend
Mid Glamorgan - CF31-3PY
United Kingdom
☎ (Customer Service): +44 - (0) 1656 - 647 372
Fax (Customer Service): +44 - (0) 1656 - 649 016

Mecc San S.R.L.
Via Dei Pini, 35
I - 36016 Thiene (VI)
ITALIA
☎: +39 - (0) 445-380059
Fax: +39 - (0) 445-380034

Invacare® AS
Grensesvingen 9
0603 Oslo
Norge
☎ (Kundeservice): +47 - 22 57 95 10
Fax (Kundeservice): +47 - 22 57 95 01

Invacare® B.V.
Celsiusstraat 46
NL-6716 BZ Ede
The Netherlands
☎ : +31 - (0) 318 - 69 57 57
Fax: +31 - (0) 318 - 69 57 58

Invacare® PORTUGAL Lda
Rua Senhora de Campanhã, 105
4369-001 Porto
PORTUGAL
☎ : +352-225105946
Fax: +352-225105739

Invacare® AB
Fagerstagatan 9
163 91 Spånga
Sverige
☎ (Kundtjänst): +46 - (0) 8 761 70 90
Fax (Kundtjänst): +46 - (0) 8 761 81 08
sweden@invacare.com

Service
INVACARE
JÄRFÄLLA
☎: +46 - (0) 8 – 621 08 44
Fax: +46 - (0) 8 – 621 08 45
Invacare.jarfalla@.swipnet.se

MÖLNDAL
☎: +46 - (0) 31 – 86 36 00
Fax: +46 - (0) 31 – 86 36 06
gborg.scanmob@swipnet.se

LANDSKRONA
☎: +46 - (0) 418 – 285 40
Fax: +46 - (0) 418 – 180 89
invacare.la@swipnet.se

OSKARSHAMN
☎: +46 - (0) 491 – 101 40
Fax: +46 - (0) 491 – 101 80
invacare.O-hamn@swipnet.se

Invacare® S.A. Belgium
Autobaan 14
8210 Loppem (Brugge)
BELGIUM
☎ (Kundeservice): +32 (50) 831010
Fax (Kundeservice): +32 (50) 831011

Contents

1 GENERAL INFORMATION 6

2 TRANSPORT 6

3 IMPORTANT SYMBOLS USED IN THIS MANUAL 6

4 SAFETY INFORMATION 7

4.1 Before working 7

4.2 During work: 7

4.3 After work: 8

5 TOOL LIST 8

6 LAYOUT OF COMPONENTS AND DISPLAYS AND CONTROLS 9

7 MAINTENANCE PLAN 10

8 TROUBLESHOOTING 12

8.1 General 12

8.2 Fault causes 12

8.3 Fault and diagnosis codes 13
8.3.1 Status display error codes 13

9 MAINTENANCE AND REPAIR 14

9.1 Seat unit 14
9.1.1 Components: Backrest and seat 14
9.1.2 Components: Seat unit 15
9.1.3 Components involved 16
9.1.4 Reassembly information 16
9.1.5 Reassembly information for "removing seat unit"“ 16
9.1.6 Reassembly information for "removing seat tube" 16
9.1.7 Reassembly information for "replacing seat unit" 16

9.2 Steering column 17
9.2.1 Components: 17
9.2.2 Components involved: 17
9.2.3 Reassembly information for "removing steering column" 18
9.2.4 Reassembly information for "replacing joint" 18

9.3 Panelling 19
9.3.1 Components: 19
9.3.2 Components involved: 19

9.4 Chassis 20
9.4.1 Components: 20

9.4.2 Components involved: 20
9.4.3 Reassembly information for "replacing anti-tipper wheels 20

9.5 Steering fork / front wheel 21
9.5.1 Components: 21
9.5.2 Components involved: 21
9.5.3 Preparation forreassembly 21
9.5.4 Reassembly sequence for "replacing steering head bearings / steering fork 22
9.5.5 Reassembly information for "replacing steering head bearings" 22
9.5.6 Reassembly sequence for "replacing the wheel bearing" 22

9.6 Drive unit 23
9.6.1 Components: 23
9.6.2 Components involved: 23
9.6.3 Preparation forreassembly 24
9.6.4 Reassembly sequence for "replacing carbon brushes" 24
9.6.5 Reassembly sequence for "replacing the drive unit" 24

9.7 Drive wheels 25
9.7.1 Components: 25
9.7.2 Components involved: 25
9.7.3 Reassembly information for "replacing drive wheels" 25

10 SERVICE AND REPAIR - ELECTRICS AND ELECTRONICS 26

10.1 Batteries / main fuse / controller 26
10.1.1 Components: 26
10.1.2 Components involved: 26
10.1.3 Preparations forreassembly 27
10.1.4 Reassembly information for "removing the battery pack" 27
10.1.5 Reassembly information for "replacing the main fuse" 27
10.1.6 Reassembly sequence for "replacing the battery" 27
10.1.7 Reassembly information for "replacing the controller" 27

10.2 Operating unit 28
10.2.1 Components: 28
10.2.2 Preparations forreassembly 29
10.2.3 Reassembly sequence for "replacing steering column wiring harness 29
10.2.4 Reassembly information for "replacing the drive regulator potentiometer" 30

11 TEST SEQUENCES - ELECTRICS / ELECTRONICS 31

11.1 Checking the battery voltage 31
11.1.1 Hints for Testing: 31
11.1.2 Checking total voltage of the batteries in non-operative state and under load 31
11.1.3 Testing the individual voltage of the batteries 31
11.1.3 32

11.2 Check drive motor 32
11.2.1 Motor coil continuity 32
11.2.2 Magnet brake 33
11.2.3 Freewheel switch 33
11.2.4 Carbon brushes 33

11.3 Checking power supply to operating unit 34

11.4 Checking power supply to operating unit 34

12 APPENDIX 35

12.1 Charging of fully discharged batteries 35

12.2 Connecting the programming device 35
12.2.1 Preparation 35
12.2.2 Connecting the programming device 36

1 General information

- ***PLEASE READ THROROUGHLY BEFORE CARRYING OUT REPAIRS!***
- These repair instructions are only valid in connection with the operating manual for the appropriate Scooter.
- Information about operation or about general maintenance and care work should be taken from the Scooter Operating Manual.
- Service and maintenance work described in the operating manual will not be further dealt with in the repair instructions.
- Please observe all safety instructions.
- You can find information about ordering spare parts in the spare parts catalog.
- The Scooter may only be maintained and overhauled by qualified personnel.
- The minimum requirement for service technicians is relevant training, such as in the cycle or orthopaedic mechanics fields, or suitably long-term job experience.
- Experience and knowledge of electrical measuring devices (Multimeter) is also a requirement.
- Alterations to the Scooter which occur as a result of incorrectly or improperly executed maintenance or overhaul work lead to the exclusion of all liability on the side of INVACARE.
- We reserve the right to make any alterations on the grounds of technical improvements.

2 Transport

If the Scooter or Scooter components need to be sent to INVACARE for major repairs, please observe the following information:

- Pack the Scooter or its components so they cannot be damaged during transport. If possible, use the original packaging which the Scooter or its components were sent in.
- Please attach a precise description of the fault.

3 Important symbols used in this manual

CAUTION*:*This symbol warns you of danger!

- Always follow the instructions in order to avoid injuries or damage to the Scooter!

Note:

This symbol identifies general information which is intended to simplify working with the Scooter and which refers to special functions.

4 Safety information

4.1 Before working

Note:

- Mark the current settings on the Scooter (seat, armrest, backrest etc.). This makes rebuilding the Scooter much easier.
- Before disassembling electrical components, mark the plug connections corresponding to the cables This makes reassembly easier.

CAUTION*:*Injury hazard!

- *Observe carefully all information in the repair and operating manual belonging to the Scooter!*
- *Please note the high weight of some components*.*This applies especially to removal of drive units and batteries.*
- *The Scooter must be switched off before removal of voltage-carrying components.To do this remove the battery.*
- *When making measurements on voltage-carrying components, avoid short-circuiting the contacts.*
- *Use only undamaged tools in good condition*.

4.2 During work:

NOTE:

- All plugs are fitted with mechanical snap-in safety devices which prevent release of the connecting plugs during operation.
  The snap lever on these devices must be pressed in before removing the connecting plug.
- When reassembling the plugs, ensure that these safety devices are correctly engaged.
- Always replace any cable binders removed during dissassembly with new ones.

CAUTION*:*Injury hazard!

- *Prop up the lifted* Scooter *with appropriate supports before starting the disassembly orassembly.*
- *Always use washers of the correct size.*

CAUTION*:*Risk of accidents!

- *When reassembling, always replace old self locking nuts with new ones!*

4.3 After work:

NOTE:

- Always ensure that the Scooter settings are returned to their previous values (seat, armrest, backrest etc.).

CAUTION*:*Risk of accidents!

- *Check all fixings for tight fit*.
- *Check all parts for correct interlocking.*
- *Check all displays and controls for correct working order.*

- ***ALWAYS carry out a trial run after completing any repair or maintenance work.***

5 Tool list

You will need a standard tool set with at least the following:

- Open-end and ring spanner size 6, 7, 8, 10, 11, 12, 13, 17, 19 (mm)
- Allen key 2.5, 3, 4, 5, 6, 8, 10 (mm)
- torque wrench (commercial)
- socket spanner set
- slot-headed screwdrivers (various)
- Phillips screwdriver No. 1, 2, 3
- oblique pliers
- flat-nosed pliers
- pointed pliers
- plumber's wrench
- cable lug pliers
- plastic hammer
- wheel bearing puller
- Multimeter with probes and various cable clips
- drive wheel hub puller (available from INVACARE Service)

6 Layout of components and displays and controls

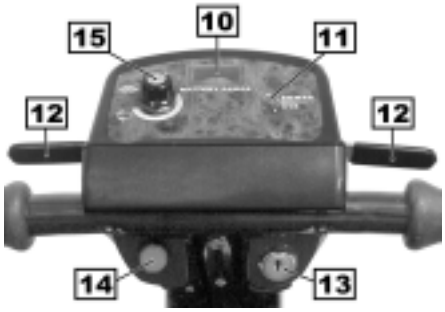
The following illustrations show the general arrangement of the Electra Scooter's subassemblies, components and control elements.

1. Seat element with armrest and backrest
2. Steering column
3. Chassis with panelling
4. Lever for turning and removing seat
5. Disengaging lever for drive unit
6. Antitipper
7. Footplates
8. Disengager for steering column adjustment
9. Operating unit

"Electra Scooter" standard configuration

Rear wheel drive with standard seat

10. Battery charge display
11. Power pilot light (status display)
12. Drive lever
13. Keyswitch
14. Horn button
15. Speed controller



16. Charging socket

7 Maintenance plan

Carry out an inspection on the Scooter using the maintenance plan. You can make this inspection easier by copying the maintenance plan and noting any defects found in the plan.

Item:	Checks	OK	Defect	Remedy
1.0	**Seat:**			
1.1	Check armrest for damage and tight fit (pay special attention to welded seams)			Replacing components chapt.: 9.1 page: 14
1.2	Check folding mechanism for armrests (ease of movement, no play in joints)			
1.3	Check armrest width adjustment correct functioning.			
1.4	Check backrest and backrest frames for damage and tight fit (pay special attention to welded seams)			
1.5	Check backrest height adjustment for correct functioning.			
1.6	Check seat and seat frames for damage and tight fit (pay special attention to welded seams)			
1.7	Check seat support tube for damage.			
1.8	Check seat unit rotation and unlocking lever for correct functioning.			
2.0	**Steering:**			
2.1	Check all steering column components for damage.			Replacing components chapt.: 9.2 page: 17
2.2	Check steering column folding mechanism for correct functioning.			Replacing components chapt.: 9.2 page: 17
2.3	Check folding joint teeth for damage.			
3.0	**Chassis:**			
3.1	Check frames for damage and deformation (pay special attention to welded seams)			Replacing components chapt.: 9.3 Page 19
3.2	Check panelling for damage			
3.3	Check reflectors for damage			
3.4	Check steering had bearings for smooth running and zero backlash.			
3.5	Check wheel rims for damage and side play			Replacing components chapt.: 0 page: 21
3.6	Check tyres for wear and damage			
3.7	Anti-tipper:			Replacing components chapt.: 9.3 page: 19
3.7.1	↳Check all anti-tipper components for damage.			
3.7.2	↳ Check track rollers for smooth running.			

Item:	Checks	OK	Defect	Remedy
4.0	**Drive unit:**			
4.1	Check functioning and smooth running of motor and gearbox			Replacing components chapt.: 9.6 page: 23
4.2	Check motor clutch for push mode			
4.3	Check connection between drive unit and chassis for tight fit			
4.4	Check condition and tight fit of all cables and connecting plugs			
4.5	Check wheels for tight fit			Replacing components chapt.: 9.6 page: 23
4.6	Check wheel rims for damage and side play			
4.7	Check tyres for wear and damage			
5.0	**Batteries:**			
5.1	Check condition and tight fit of all cables and connecting plugs			Replacing components chapt.: 10.1 page: 26
5.2	Check batteries for damage			
5.3	Check battery condition			
5.4	Check battery contacts			
5.5	Check battery voltage			Chapt.: 11.1 page: 31
6.0	**Operating unit**			
6.1	Check operating unit for damage.			Chapt.: 10.2 page: 28
6.2	Check operating unit pilot lights for correct functioning			
6.3	Check drive lever for correct functioning			
6.4	Check operating unit displays and controls for correct functioning			
6.5	Check drive disabler and lock for correct functioning			
7.0	**Controller:**			
7.1	Check condition and tight fit of all cables and connecting plugs			Replace defective cables
7.2	Check controller for damage			Replacing defective components see chapt.: 10.1 page: 26
8.0	**General**			
8.1	Retighten all holders and screws			
8.2	Trial run with examination of drive parameters (acceleration / speed in bends / braking behaviour)			

8 Troubleshooting

8.1 General

You can determine the reason for faults in the Scooter in drive mode, on the server motors or in the power supply by carrying out the following steps:

Schritt 1: Limit fault causes as per table in chapter: 8.2 page: 12.

Schritt 2: Ascertain the blink code on the operating unit status display and evaluate using the "Error codes" chapter: 8.3.1 page: 13.

Schritt 3: Ascertain the error message using the programming device and evaluate it (observe programming device operating manual and chapter 12.2 page: 35).

8.2 Fault causes

Fault		Cause		Measures		Description in
Scooter will not start	→	drive motors disengaged	→	engage motors	→	Operating manual
Operating unit status display has gone out	→	Operating unit switched off	→	Switch on operating unit	→	Operating manual
	↳	batteries defective	→	Replace batteries	→	Operating manual
	↳	completely discharge battery	→	Pre-charge battery	→	Chapt.: 12.1 page: 35
	↳	power supply interrupted	→	Check main fuse at batteries	→	Chapt.: 10.1 page: 27
			↳	Check all cable connecting plugs	→	
	↳	Controller defective	→	Replace controller	→	Chapt.: 10.1 page: 26
Status display flashing	→		→	Assess error code	→	Chapt.: 8.3 page: 13
Drive motor bucking	→	Motor defective	→	Replace motor		Chapt.: 9.6 page: 23
Batteries will not charge	→	Batteries defective	→	Replace battery	→	Operating manual
	↳	Charging device defective	→	Replace battery charger		

8.3 Fault and diagnosis codes

If there is an electrical fault, this is displayed by the fact that the power pilot light (11; status display) in the operating unit blinks.

This displays an error code which allows an *approximate* fault diagnosis.

The diode (11) then flashes in a particular blink sequence.

Status display

The electronics system is able to correct some errors automatically.

- Switch the Scooter off, wait five seconds, and then switch it on again.
  The test checks whether the error can be automatically rectified by the electronics, and if necessary deactivates the blinking status display at the operating unit.

If the error cannot be rectified, limit the source of error using the "Status display error codes" table (see chapter: 8.3.1 page: 13).

8.3.1 Status display error codes

Localise the error using the brink codes as follows:

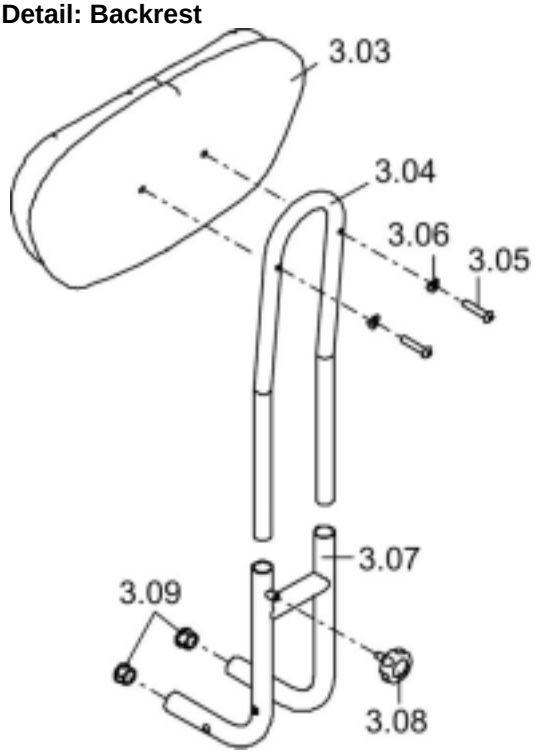
- turn the operating unit off and on again
- check which blink code is showing by counting
- wait for the blink code pause (approx. 2-3 seconds)
- re-count the code.

Error code:	Error:	Immediate measure:
1 x blink	Batteries are discharged	• Charge battery
2 x blink	Battery voltage too low	• charge batteries
3 x blink	Battery voltage too high	• Remove battery charger from charging socket • Turn the Scooter off and then on again
	Cause: the batteries can be charged during downhill runs and during braking by the motor return current.	
4 x blink	Current delay exceeded	• Switch the Scooter off and then on again after a few minutes
	Cause: maximum battery current supplier can be exceeded due to motor overload (for example running against an immovable obstacle)	
	Motor short-circuit	• Check wiring harness for short-circuit • Check motor
5 x blink	Motors disengaged	• Press disengaging lever in
	Braking coil defective	• Replace drive unit
6 x blink	Drive lever is not in neutral position when switching on	• Ensure that the drive lever is in the central position; turn the operating unit off and on again
7 x blink	Speed controller defective	• Replace speed controller
8 x blink	Motor voltage error	• Replace drive unit
9 x blink	Internal error	• Ascertain error message using programming device and evaluate

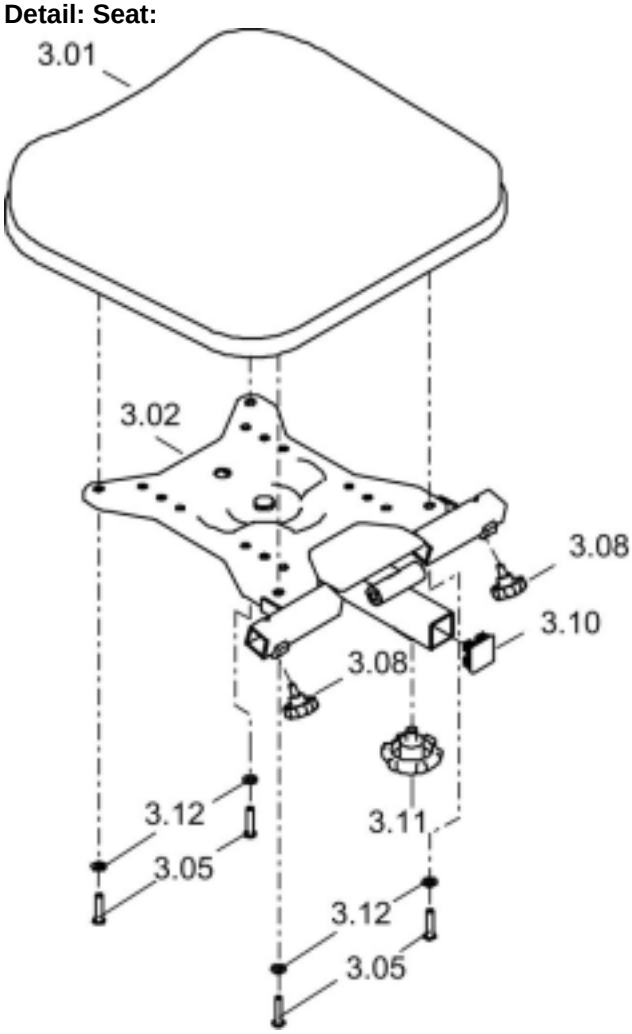
9 Maintenance and repair

9.1 Seat unit

Detail: Backrest

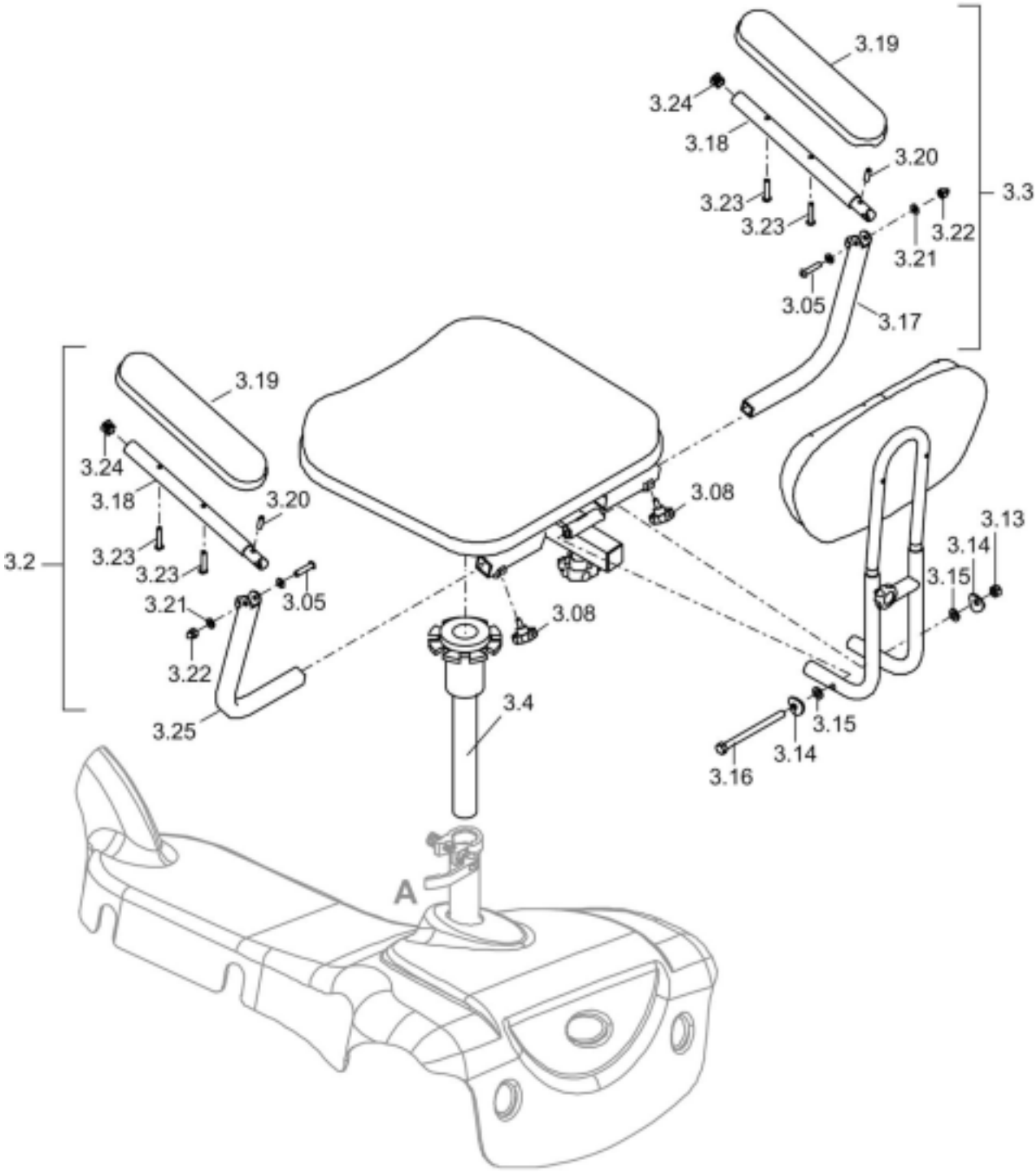


Detail: Seat:



9.1.1 Components: Backrest and seat

Item	Qty.	Description	Item	Qty.	Description
3.01	1	Seat S232, black	**3.07**	1	Bottom backrest tube S232
3.02	1	Seat plate	**3.08**	3	Knob, black
3.03	1	Backrest S232, black	**3.09**	2	Plug, black
3.04	1	Top backrest tube S232	**3.10**	1	End plug 30 X 30,black
3.05	6	Bolt, M6 X 30	**3.11**	1	Knob, M10 X 13
3.06	2	Washer	**3.12**	4	Washer



9.1.2 Components: Seat unit

Item	Qty.	Description	Item	Qty.	Description
3.05	2	Bolt, M6 X 30	**3.20**	2	Bolt, M6 X 16
3.08	2	Knob, black	**3.21**	2	Washer, M6 X 1
3.13	1	Nut M8, self-locking	**3.22**	2	Nut, M6 with plastic cap
3.14	2	Spring washer M8	**3.23**	4	Bolt, M6 X 30
3.15	2	Washer, M8 X 1,5	**3.24**	2	Plug, black
3.16	1	Pin, M8 X 110	**3.25**	1	Armrest tube, LH
3.17	1	Armrest tube RH			
3.18	2	Armrest tube	**3.4**		Seat tube, complete
3.19	2	Armrest upholstery, black			

9.1.3 Components involved

A Panelling (chapter: 9.3 page: 19

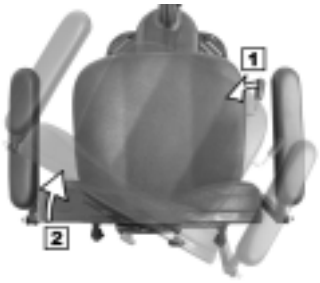
9.1.4 Reassembly information

Before disassembling the seat unit, mark the height of the seat attachment (3.4), the backrest and the armrest width settings.

9.1.5 Reassembly information for "removing seat unit"“

- Pull release lever(1).
- Turn the seat unit by about ¼ revolution to the right or left (2) and remove the seat unit upwards out of the seat attachment.

Removing seat unit (top view)



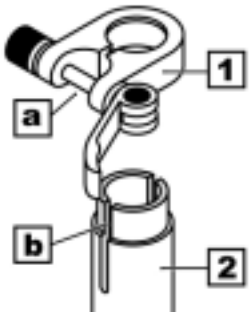
9.1.6 Reassembly information for "removing seat tube"

- Loosen the clamp lever and remove seat tube.

9.1.7 Reassembly information for "replacing seat unit"

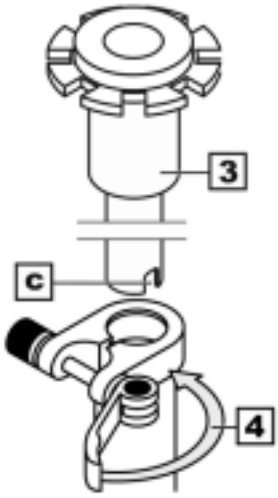
- Place the clamp (1) on the seat tube (2).
  The clamp opening (a) must be in alignment with the slot in the seat tube (b).

Making the clamp fast

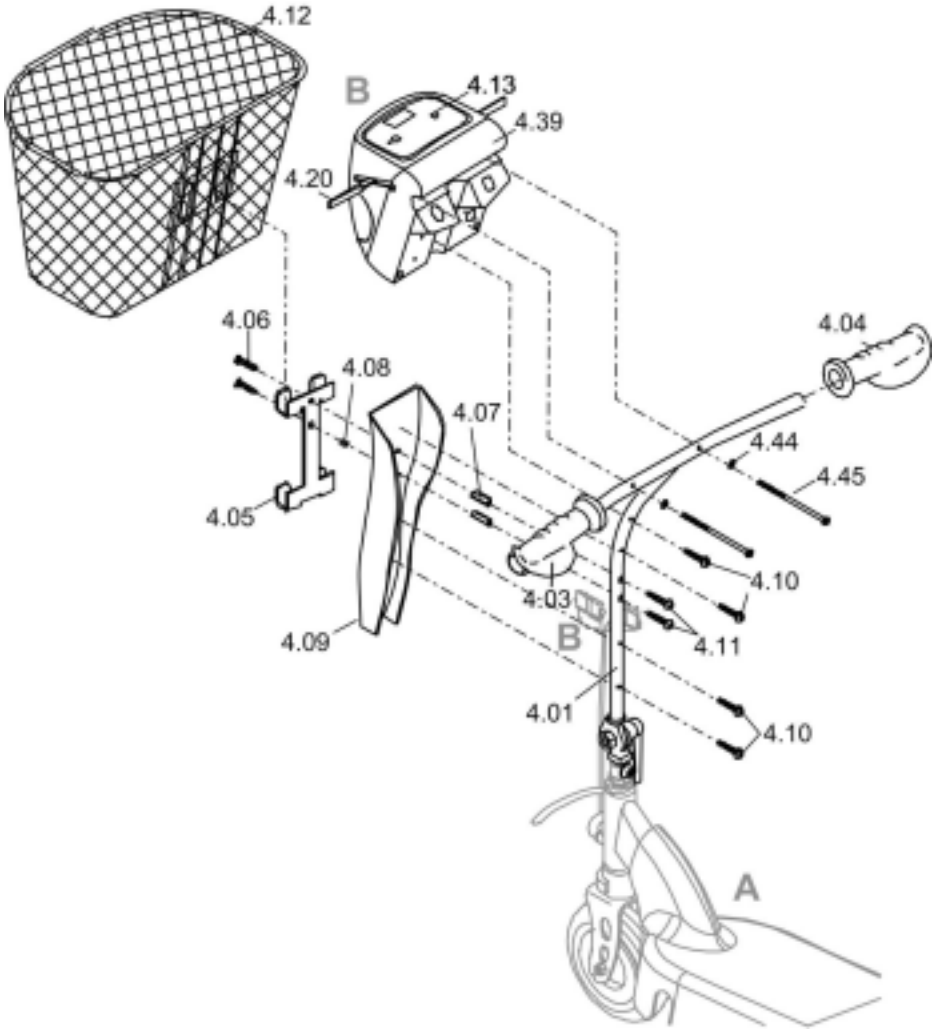


- Push the seat tube (3) into the attachment tube and turn until the guide groove (c) noticeably locates into the seat tube anti-turn device
- Tighten clamp (4).

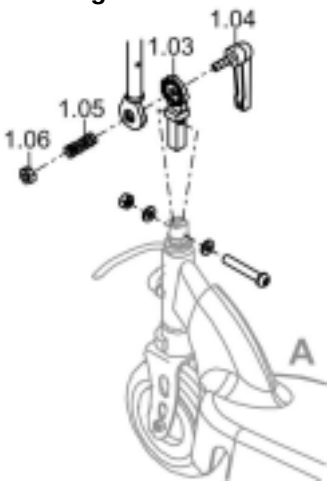
Pushing in seat tube



9.2 Steering column



Detail: connection to steering fork



9.2.1 Components:

Item	Qty.	Description	Item	Qty.	Description
4.01	1	Handlebar S533	**4.13**	1	Steering cover, top
4.03	1	Handle, LH	**4.20**	1	Drive lever
4.04	1	Handle, RH	**4.39**	1	Steering cover, bottom
4.05	1	Basket holder	**4.44**	2	Washer, M4
4.06	2	Bolt, M6 X 10	**4.45**	2	Bolt, M4 X 95
4.07	2	Bush 6 x 20 x 1			
4.08	1	Spacer	**1.03**	1	Steering column attachment
4.09	1	Steering cover, front	**1.04**	1	Clamping lever
4.10	4	Bolt, M4 X 30	**1.05**	1	Pressure spring
4.11	2	Bolt, M6 X 35	**1.06**	1	Nut, M10 X 1,5, self-locking
4.12	1	Basket			

9.2.2 Components involved:

A Chassis (chapter: 9.3 page: 19)

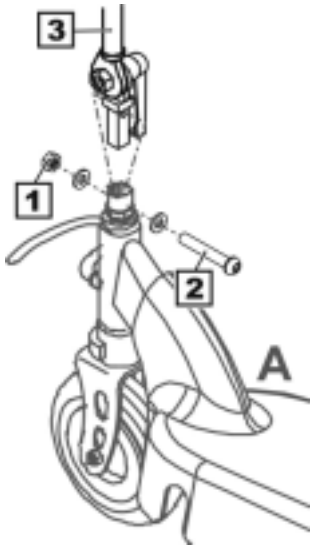
B Operating unit (chapter: 10.2 page: 28)

9.2.3 Reassembly information for "removing steering column"

Connecting plugs

- Remove seat unit (see chapter9.1.5).
- Carefully pull the chassis panelling upwards off the Velcro connectors.
- Interrupt power supply. Battery cable (1).
- Disconnect the power supply connecting plug at the operating unit (2) and the connecting plug at the controller (3).

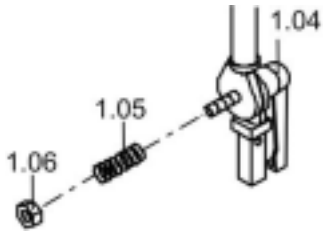
Steering column joint



- Loosen self-locking nut (1; size 13 mm).
- Remove connecting bolts (2; Allen key size 4 mm).
- Pull the steering column (3) out of the steering head.

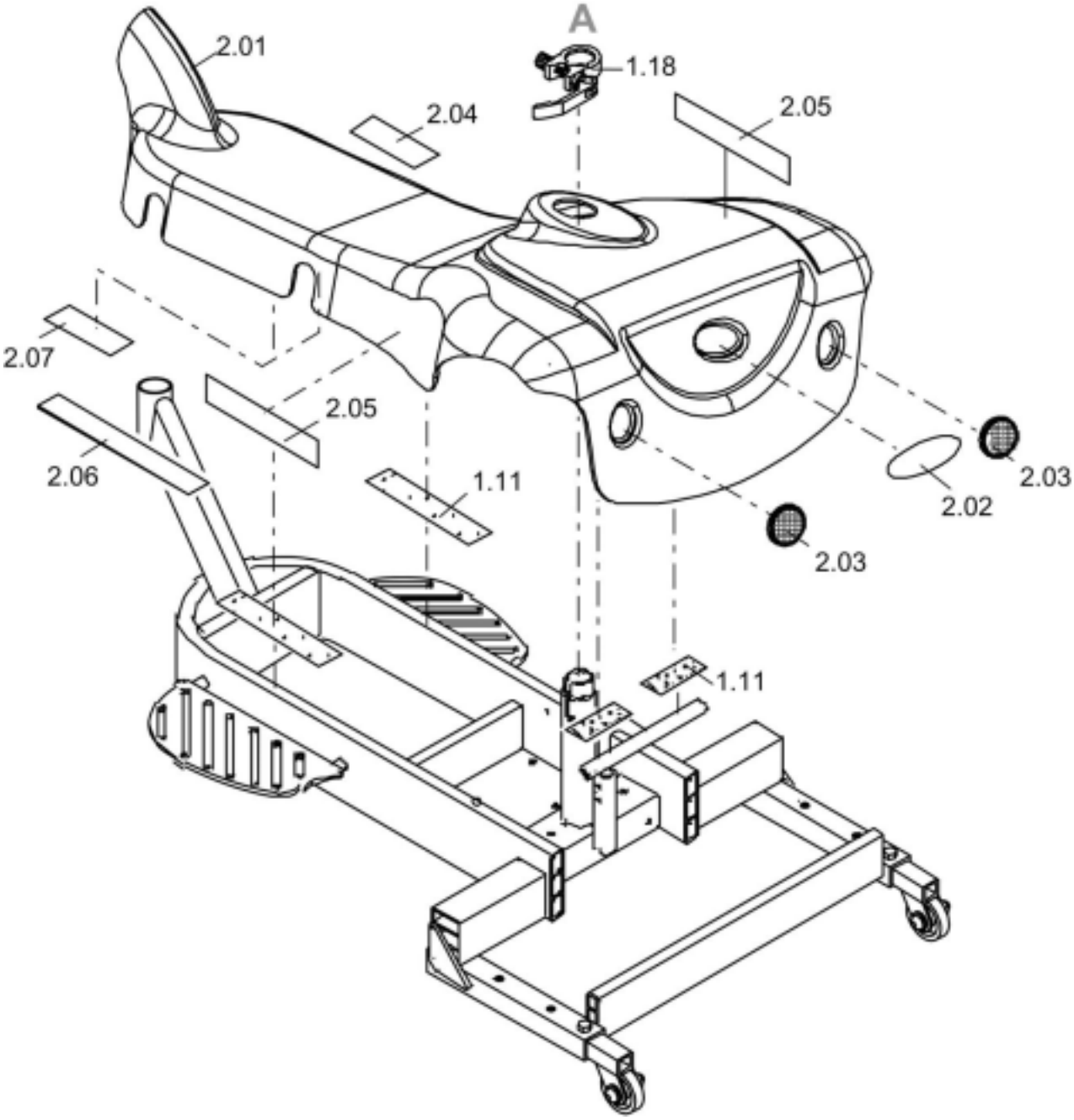
9.2.4 Reassembly information for "replacing joint"

Screwing down the steering column joint



- Turn the self-locking nut (1.06; size 13 mm) just far enough so that it locks off flush with the clamping lever bolt (1.04).

9.3 Panelling



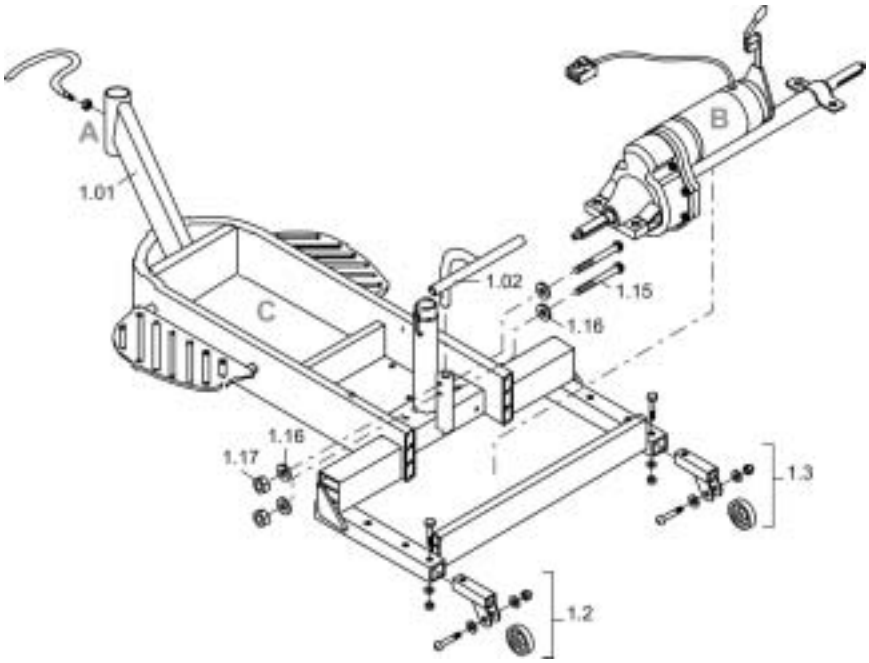
9.3.1 Components:

Item	Qty.	Description
1.11	4	Velcro loop strip 50 X 25
1.18	1	Snap buckle
2.01	1	Panelling
2.02	1	"INVACARE" sticker
2.03	2	Reflector
2.04	1	Reflector, red
2.05	1	"ELECTRA" sticker
2.06	1	Velcro strap 50 X 25
2.07	1	"Battery wiring circuit" sticker

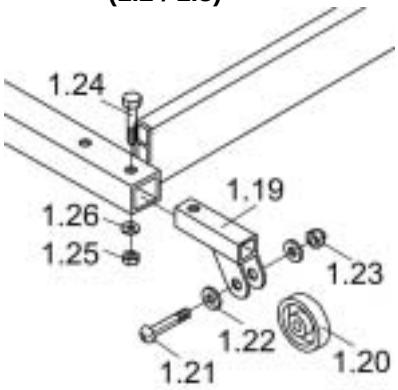
9.3.2 Components involved:

A Seat unit (chapter: 9.1 page: 14)

9.4 Chassis



Detail: antitipper (1.2 / 1.3)



9.4.1 Components:

Item	Qty.	Description	Item	Qty.	Description
1.01	1	Chassis unit, complete	**1.19**	1	Fixing for anti-tipper wheel
1.02	1	Fixing for rear panelling	**1.20**	1	Anti-tipper wheel, 40 mm
1.15	2	Bolt, M6 X 30	**1.21**	1	Bolt, M6 X 36,5
1.16	4	Washer, M5	**1.22**	2	Washer, M6
1.17	2	Nut, M5	**1.23**	1	Nut M6 self-locking
			1.24	1	Bolt, M8 X 40
1.2	1	Anti-tipper unit, LH	**1.25**	1	Nut M8, self-locking
1.3	1	Anti-tipper unit, RH	**1.26**		Washer, M8

9.4.2 Components involved:

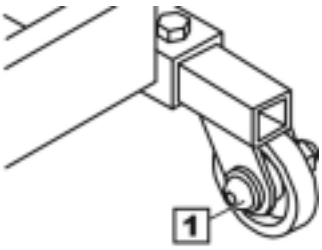
A Steering fork / front wheel (chapter: 0 page: 21)

B Drive unit (chapter: 9.6 page: 23)

C Battery / electronics (chapter: 10.1 page: 26)

9.4.3 Reassembly information for "replacing anti-tipper wheels

- Only tighten the fixing bolts (1) on the anti-tipper wheel enough to make sure that the anti-tipper wheels turn freely.



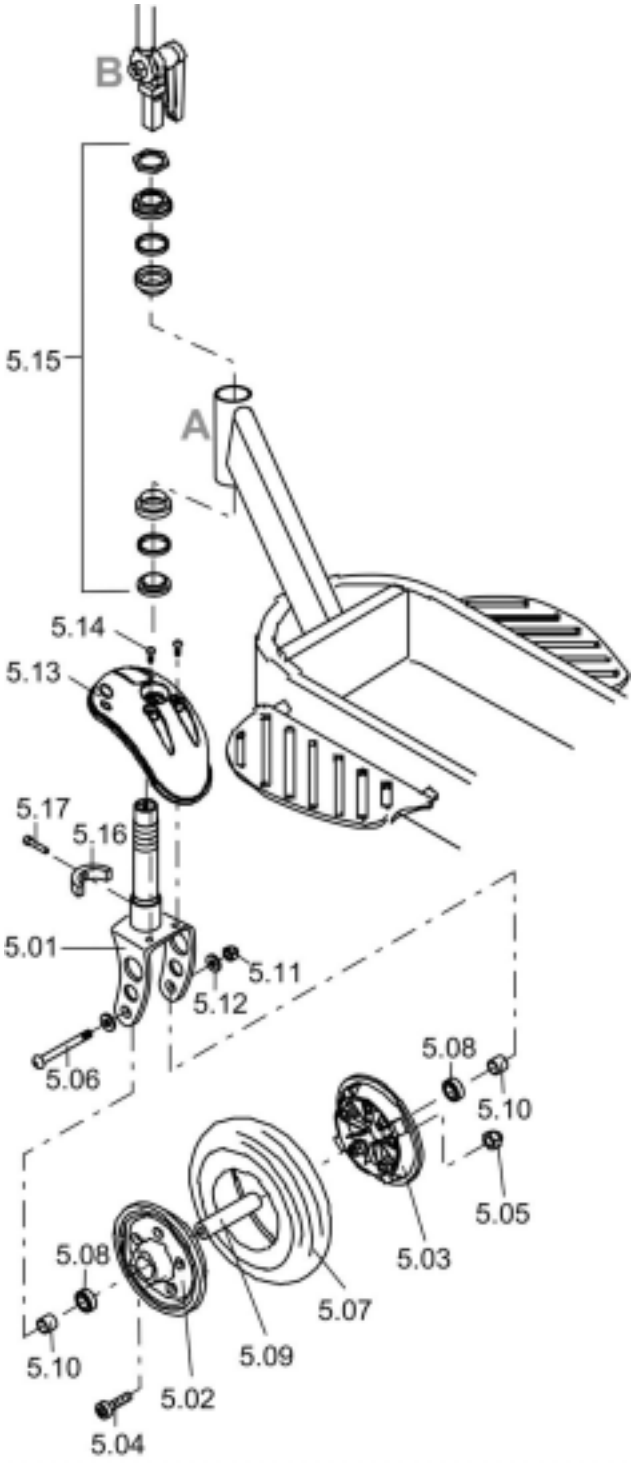
CAUTION*:*Risk of accidents!

- *In vehicles with rear wheel drive, the installation of the anti-tip mechanism is absolutely imperative.*

9.5 Steering fork / front wheel

9.5.1 Components:

Item	Qty.	Description
5.01	1	Front wheel fork
5.02	1	Wheel rim 200 X 50 5H, black
5.03	1	Wheel rim 200 X 50 6H, black
5.04	4	Bolt, M6 X 30
5.05	4	Nut M6 self-locking
5.06	1	Axle, M8 X 82
5.07	1	Tyre 200 X 50, puncture-proof
5.08	2	Bearings 608 ZZ
5.09	1	Spacer bush, 11 X 42 X 1,2
5.10	2	Spacer bush 11 X 3,1 X 1,2
5.11	1	Nut M8, self-locking
5.12	1	Washer, M8
5.13	1	Front wheel cover
5.14	2	Bolt, M6 X 10
5.15	1	Bearing set, 8-pc. for front wheel fork
5.16	1	Stopper for steering stop
5.17	1	Pin, M6 X 25



9.5.2 Components involved:

A Chassis (chapter: 9.4 page: 20)

B Steering column (chapter: 9.2 page: 17)

9.5.3 Preparation for reassembly

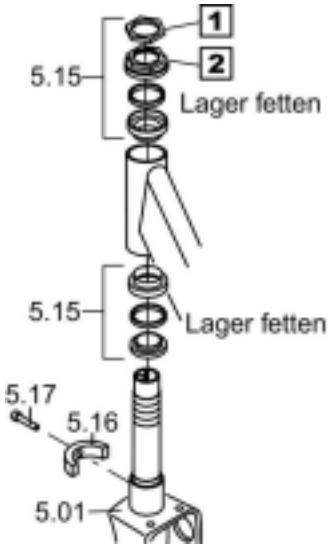
- Raise the Scooter and place on a suitable support (such as wooden block).
  The steering wheel must not be subjected to load.

CAUTION*: *Danger of crushing!
Secure the raised Scooter against slipping and rolling away.

9.5.4 Reassembly sequence for "replacing steering head bearings / steering fork

- Remove the steering column (chapter: 9.2.3 page: 18).
- Remove the steering fork and replace the steering head bearings.
  Locknut (1, size 32 mm)
  adjusting nut (2, size 32 mm)

Replacing the steering head bearings



9.5.5 Reassembly information for "replacing steering head bearings"

- Always use a suitable striking tool for inserting the bearing shells

Inserting the bearing shells

9.5.6 Reassembly sequence for "replacing the wheel bearing"

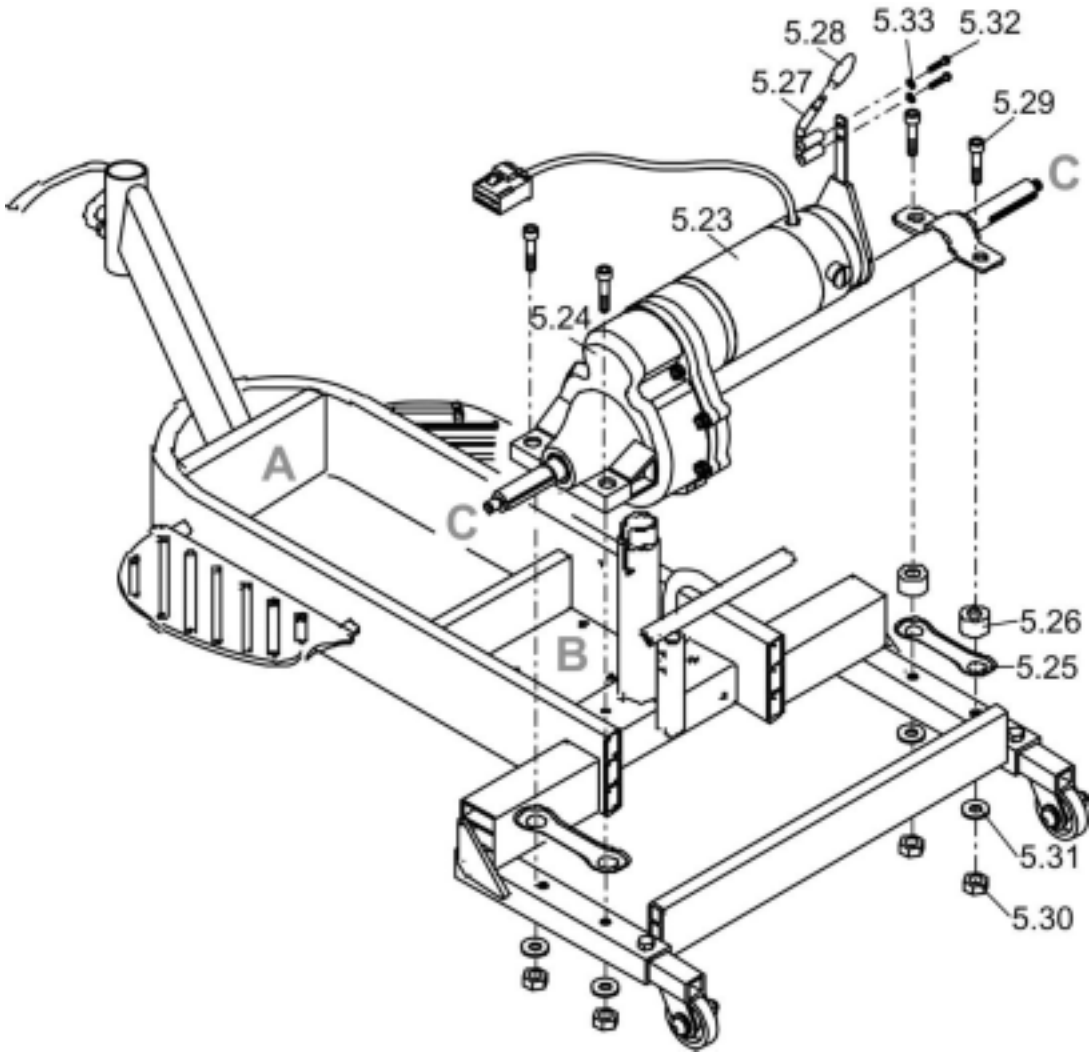
- Remove the steering wheel
  Hex bolts (size 13 mm) / nuts (size 13 mm).
- Split the wheel rim. Allen key bolt (size 4 mm).
- Remove the wheel bearing with suitable tools.
- Always use a suitable striking tool for inserting the wheel bearings.

Replacing the wheel bearing

Note:

- Only tap the wheel bearing into the wheel rim so far that it is flush with the rim edge.

9.6 Drive unit



9.6.1 Components:

Item	Qty.	Description
5.23	1	Drive unit
5.24	1	Reduction gears
5.25	2	Rubber bumper
5.26	2	Spacer
5.27	1	Disengaging lever
5.28	1	Knob

Item	Qty.	Description
5.29	4	Bolt, M8 X 55
5.30	4	Nut M8, self-locking
5.31	4	Washer, M8 X 1,6
5.32	2	Bolt, M5
5.33	2	Spring washer, M5

9.6.2 Components involved:

A Chassis (chapter: 9.4 page: 20)

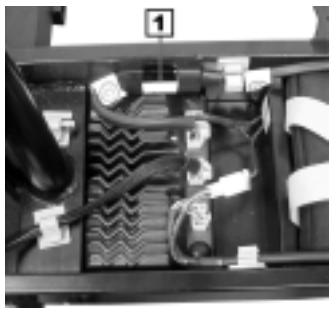
B Battery / electronics (chapter: 10.1 page: 26)

C Drive wheels (chapter: 9.7 page: 25)

9.6.3 Preparation for reassembly

- Remove seat unit (see chapter9.1.5).
- Remove clamp and seat tube (see chapter 9.1.6)
- Carefully pull the chassis panelling upwards off the Velcro connectors.
- Interrupt power supply. Battery cable (1).

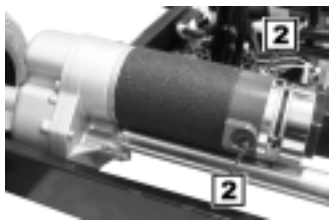
Battery plug



9.6.4 Reassembly sequence for "replacing carbon brushes"

- Carry out preparations for reassembly.
- Loosen the slotted screw (2) and remove the carbon brushes from the guide.

Carbon brush position



NOTE:

- Always replace both carbon brushes.
- The carbon brushes may not be tilted when fitting and they must be able to move smoothly within their guides

9.6.5 Reassembly sequence for "replacing the drive unit"

- Carry out preparations for reassembly.
- Raise the Scooter and place on a suitable support (such as wooden block).
  The drive wheels must not be under load.

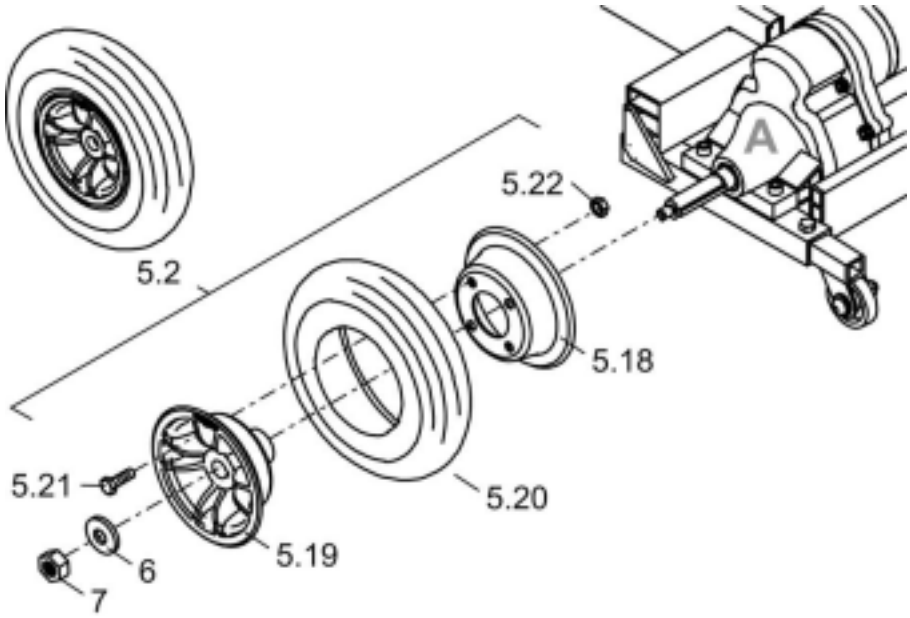
CAUTION*:*Danger of crushing!

Secure the raised Scooter against slipping and rolling away.

- Remove the drive unit connecting plug at the controller (3).
- Remove the drive wheels (see chapter 9.6 page: 23).
- Remove the drive unit.
  Allen key bolts (size 4 mm) / nuts (size 13 mm).

Drive unit connecting plug

9.7 Drive wheels



9.7.1 Components:

Item	Qty.	Description	Item	Qty.	Description
5.2	1	Rear wheel unit	**5.22**	4	Nut M8, self-locking
5.18	1	Wheel rim (B) 7"	**6**	1	Nut M8, self-locking
5.19	1	Wheel rim rear wheel	**7**	1	Washer, M8
5.20	1	Tyre 200 X 50, puncture-proof			
5.21	4	Bolt, M8 X 15			

9.7.2 Components involved:

A Drive unit (chapter: 9.6 page: 23)

9.7.3 Reassembly information for "replacing drive wheels"

Raise the Scooter and place on a suitable support (such as wooden block).
The drive wheels must not be under load.

CAUTION*:*Danger of crushing!
Secure the raised Scooter against slipping and rolling away.

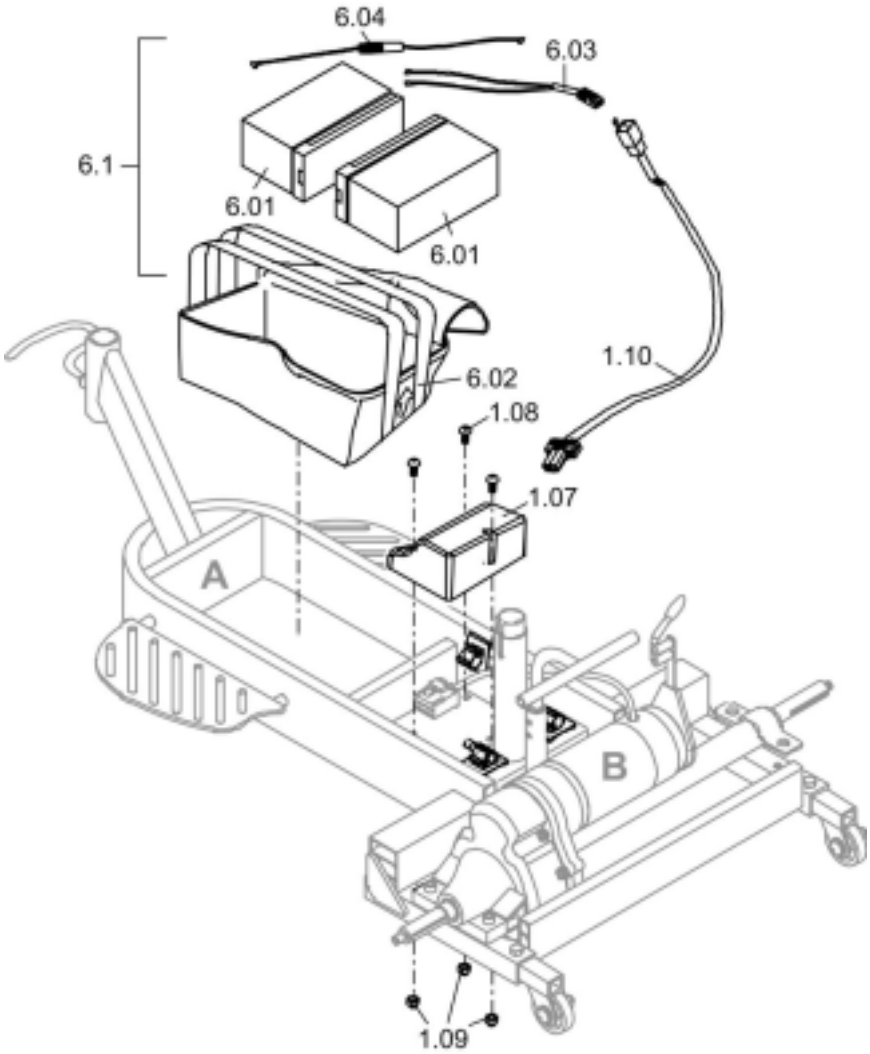
- Remove the drive wheel. - Self-locking nut (size 13 mm)

Note:

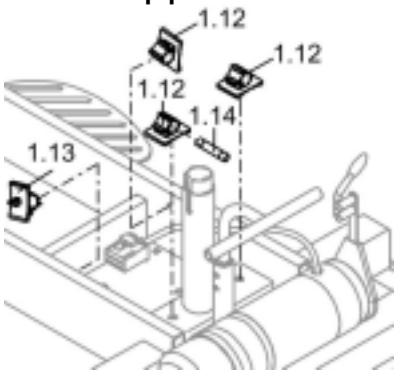
- Do not tap the drive wheels off the motor shaft with a hammer (causes damage to aluminium wheel rim. Use a pulling tool!

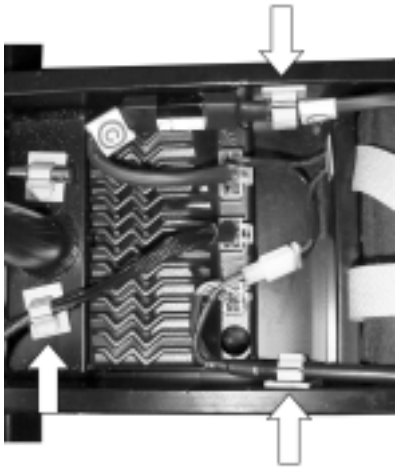
10 Service and repair - electrics and electronics

10.1 Batteries / main fuse / controller



Detail:
Cable clamp position





10.1.1 Components:

Item	Qty.	Description
1.07	1	Electronics, RHINO DS 72 K01
1.08	3	Bolt, M4 X 25
1.09	3	Nut M4, self-locking
1.10	1	Mains cable
1.12	1	Cable holder, PTS-0910
1.13		Cable holder, PTS-1214
1.14		40 A fuse

Item	Qty.	Description
6.1	1	Battery, complete
6.01	2	Battery, SP-53
6.02	1	Pocket, black
6.03	1	Cable with connector plug, complete
6.04	1	Cable with fuse, complete

10.1.2 Components involved:

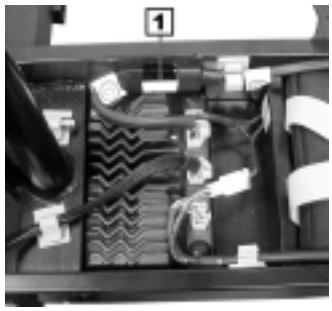
A Chassis (chapter: 9.4 page: 20)

B Drive unit (chapter: 9.6 page: 23)

10.1.3 Preparations forreassembly

- Remove seat unit (see chapter9.1.5).
- Remove clamp and seat tube (see chapter 9.1.6)
- Carefully pull the chassis panelling upwards off the Velcro connectors.

Battery plug



10.1.4 Reassembly information for "removing the battery pack"

- Separate the battery cable connecting plug (1).
- Remove the battery pack from the chassis.

10.1.5 Reassembly information for "replacing the main fuse"

The fuse holder (2) is inserted in the battery cable bridge.

It is fitted with a turn-lock fastener.

Main fuse

10.1.6 Reassembly sequence for "replacing the battery"

- Loosen the battery cable in the following sequence:
  1. Remove the cable bridge negative terminal with main fuse.
  2. Remove the cable bridge positive terminal with main fuse.
  3. Loosen the battery cable negative terminal.
  4. Loosen the battery cable positive terminal.

Removing the battery cable

***CAUTION*:**

- *Risk of short circuit.Take care with tools.Do not bridge battery terminals*

Plug allocation:

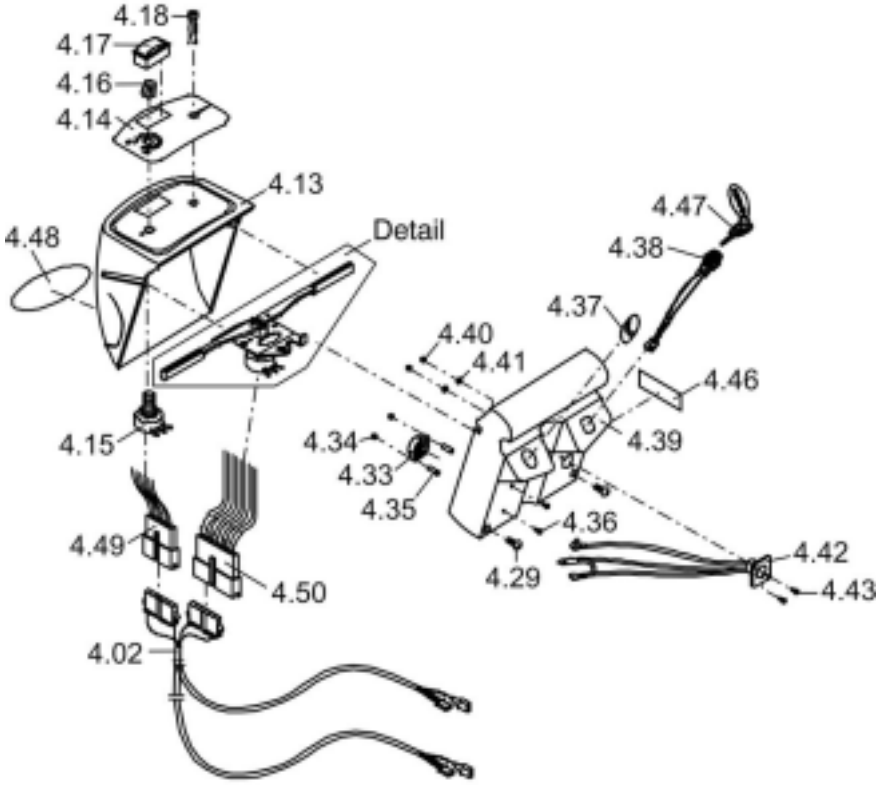
10.1.7 Reassembly information for "replacing the controller"

- Disconnect all connecting plugs on the controller

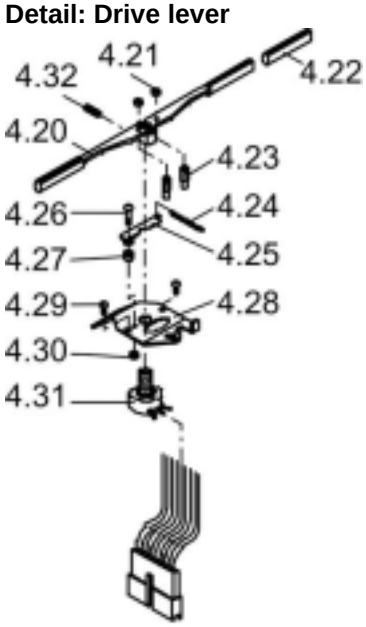
  Plug allocation:
  1. Power feed battery cable
  2. Drive unit
  3. Operating unit

- Replace controller.
  Phillips screws (a) / nuts (size 8 mm)

10.2 Operating unit



Detail: Drive lever



10.2.1 Components:

Item	Qty.	Description
4.02	1	Main wiring harness
4.13	1	Steering cover, top
4.14	1	Sticker S532
4.15	1	Potentiometer, VR 30 K
4.16	1	Potentiometer knob

Item	Qty.	Description
4.48	1	"INVACARE" sticker
4.49	1	Wiring harness, steering PCB top
4.50	1	Wiring harness, steering PCB bottom

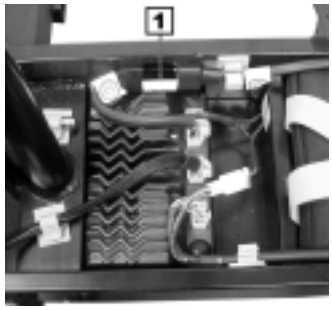
Detail: Drive lever

4.17	1	>Battery charge display
4.18	1	"ON/OFF" pilot light
4.33	1	Buzzer
4.34	2	Nut M3, self-locking
4.35	2	Spacer, 6,4 X 4 X 19,47
4.36	2	Bolt, M6 X 30
4.37	1	Horn switch
4.38	1	Keyswitch
4.39	1	Steering cover, bottom
4.40	2	Nut, M2
4.41	2	Spring washer, M2
4.42	1	Battery charging cable
4.43	2	Bolt, M6 X 12
4.46	1	"CHARGING SOCKET" sticker
4.47	1	Spanner set
4.20	1	Drive lever
4.21	2	Nut M3, self-locking
4.22	2	Drive lever rubber
4.23	2	Pin
4.24	1	Restoring spring
4.25	1	Plate
4.26	1	Bolt, M4 X 20
4.27	1	Spacer
4.28	1	Potentiometer support
4.29	2	Bolt , M4 X 0,7 X 10
4.30	1	Nut M4, self-locking
4.31	1	Potentiometer 5K
4.32	1	Bolt, M6 X 5

10.2.2 Preparations for reassembly

- Remove the seat unit (see chapter 9.1.5 page: 16).
- Remove clamp and seat tube (see chapter 9.1.6 page 16)
- Carefully pull the chassis panelling upwards off the Velcro connectors.
- Interrupt power supply. Battery cable (1).

Battery cable connector plug



10.2.3 Reassembly sequence for "replacing steering column wiring harness

- Remove steering cover (see chapter. 9.2 page: 17)
- Remove all cable binders on the steering column wiring harness.
- Disconnect all wiring harness connecting plugs at the controller (4) and the power supply (5).

Plug at controller

- Remove the operating unit from the handlebar. Three Phillips screws (1-3).

Fastening screws

- Open the operating unit. Two Phillips screws (6 + 7).

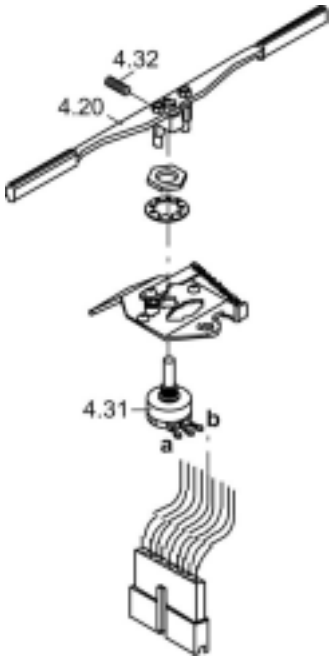
Open the operating unit

- Disconnect the wiring harness connecting plug (8) in the operating unit.
- Replace the wiring harness.

10.2.4 Reassembly information for "replacing the drive regulator potentiometer"

Replacing the potentiometer

- Disconnect the potentiometer wiring harness connecting plug (4.31).
- Remove the drive lever mechanism from the operating unit.
- Loosen the Allen screw (4.32) and remove the drive lever (4.20).
- Loosen the union nut on the potentiometer and replace the potentiometer.
- Bring the potentiometer shaft (a) into its central position by measuring the resistance.
  The shaft is in its central position when the same resistance value (approx. 2,5 kOhm) is shown at the right-hand and left-hand connecting cable (b + c).
- Fit the drive lever (4.20) and fix by tightening the Allen screw (4.32).



CAUTION*:*Risk of accidents!

- *Bring the potentiometer into the central position before fixing the drive lever!*

11 Test sequences - electrics / electronics

11.1 Checking the battery voltage

***CAUTION*:**

- *Risk of short circuit.Take care with tools.Do not bridge battery terminals*
- *Only use the gel batteries indicated in the spare parts catalogue as replacement batteries.*

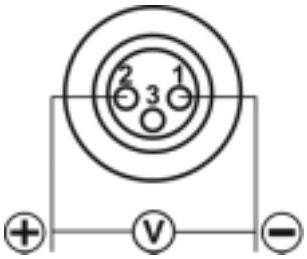
11.1.1 Hints for Testing:

- If the total voltage is below 24 V even though the batteries being charged, the battery contacts and the guide pins and exterior connection sockets are to be checked for corrosion or damage.
- If the battery voltage falls below 23 V during operation, the power supply to the motors will be interrupted and the status display on the operating unit will blink.
- Exact information on the condition of the batteries can be obtained by means of a capacity test. This can only be performed by the manufacturer.

11.1.2 Checking total voltage of the batteries in non-operative state and under load

Check total voltage U of the batteries at the Scooter charging socket between poles 1 and 2 by means of a Multimeter (measuring range 50 V / 25 V DC).

Checking total voltage (charging socket)



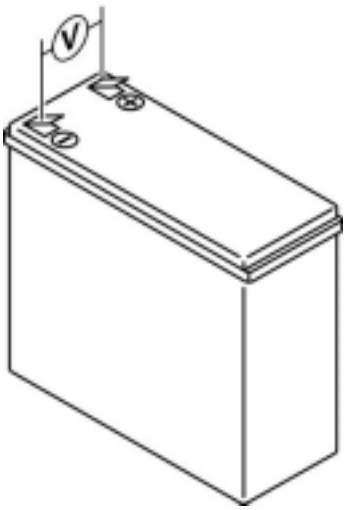
Check	Remedy
• Voltage below 24V:	Charge batteries. See chapter 12.1 page:35.
• Voltage below 19V:	Battery fully discharged. See chapter 12.1 page:35.
• Voltage is 0 V	Check fuses. The main fuse is located in the battery pack. (chapter 10.1.5 page: 27)
• Voltage (U) falls off rapidly in drive mode? Carry out measurement with blocked drive wheels and with lighting switched on.	Charge batteries. See chapter 12.1 page:35.

11.1.3 Testing the individual voltage of the batteries

Test the individual voltage U on the batteries that have been taken out by means of a Multimeter (measuring range 50 V / 25 V DC (see chapter 10.1 page: 26).

Test	Fault	Remedy
• Voltage under 12V?	⇒ Battery not completely charged.	⇒ Charge the battery with an Invacare® charger.
• Voltage under 9.5V?	⇒ Battery fully discharged.	⇒ Pre-charge battery. See chapter 12.1 page:35.
• Voltage under 0V?	⇒ Check fuses. The fuse is located in the battery cable bridges. (Chapter 10.1.5 page: 27)	⇒ "Ah Batter" Check master fuse (50 A) of battery and cable / connections, replace if necessary, replace battery if necessary
• Different voltage (tolerance ± 0.2 V) at each battery?	⇒ batteries defective	⇒ Replace batteries

Check individual voltage



11.2 Check drive motor

11.2.1 Motor coil continuity

- Remove drive unit panelling (see chapter 9.3 page: 19).
- Remove the drive unit connecting plug at the controller (3).
- Set the Multimeter to continuity check or resistance measuring.
- Measure the continuity or resistance (R_{req} = 0 Ω) of the motor circuit between the red and black cable on the motor plug.

Drive unit connector plug

Test results:			Chapter:
No continuity in motor circuit (R = ∞ Ω).	• Broken cable in motor.	⇒ Replace drive unit.	Chapter: 9.6.5 page: 24
	• Carbon brushes worn out.	⇒ Check / replace carbon brushes.	Chapter: 9.6.4 page: 24

11.2.2 Magnet brake

- Remove drive unit panelling (see chapter 9.3 page: 19).
- Remove the drive unit connecting plug at the controller (3).
- Engage motors.
- Set the Multimeter to resistance measuring.
- Measure the continuity or resistance (R_{req} = 20 Ω) of the brake coil motor circuit between the grey and white cable on the motor plug.

Drive unit connector plug

Test results:			Chapter:
R = 0 Ω.	• Short-circuit in magnetic brake.	⇒ Replace drive unit.	Chapter: 9.6.5 page: 24
R > 200 Ω, but < ∞.	• Fine short circuit in magnetic brake.	⇒ Replace drive unit.	Chapter: 9.6.5 page: 24

11.2.3 Freewheel switch

- Remove drive unit panelling (see chapter 9.3 page: 19).
- Remove the drive unit connecting plug at the controller (3).
- Disengage motors.
- Set the Multimeter to resistance measuring.
- Measure the braking coil resistance (R_{req} = ∞ Ω) between the grey and white cable in the motor plug. The measured value must be infinite.

Drive unit connector plug

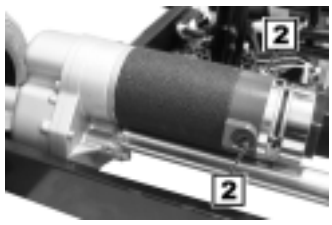
Test results:			Chapter:
R < ∞.	• Short-circuit in magnetic brake.	⇒ Replace drive unit.	Chapter: 9.6.5 page: 24

11.2.4 Carbon brushes

- Remove drive unit panelling (see chapter 9.3 page: 19).
- Remove the drive unit connecting plug at the controller.
- Remove carbon brushes (2) (see chapter 9.6.4).
- Measure the length (L)
  Original length = 18 mm.
  Wear limit = 15 mm.

Check the running surface. Only very slight running traces must be noticeable. If the running surface shows deep grooves, the motor collector is damaged. Overhaul of the motor collector can only be carried out by *Invacare*®.

Carbon brushes



Test results:			Chapter:
L < 15 mm	• Wear limit exceeded	⇒ Replace carbon brushes	Chapter: 9.6.4 page: 24
Running surface shows deep scores	• Motor collector damaged	⇒ Replace drive unit	Chapter: 9.6.5 page: 24

11.3 Checking power supply to operating unit

- Open operating unit (see chapter 10.2.3 page: 29).
- Disconnect the wiring harness connector plugs (8) from the controller in the operating unit.
- Measure the voltage between the red (+) and black (-) cables in addition to the orange (+) and violet (-) cables in the plug.
  The voltage must amount to a minimum of 19 V.

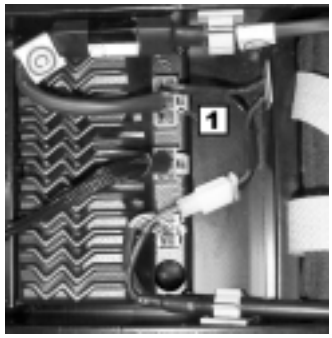
Connector plug in operating unit

Test results:			**Chapter:**
Voltage < 19 V	• Battery fully discharged.	⇒ Check battery.	Chapter: 11.1 page: 31
No voltage	• Connecting cable defective.	⇒ Replace connecting cable	Chapter: 10.2.3 page: 29
	• Controller defective.	⇒ Replace controller	Chapter: 0 page: 27

11.4 Checking power supply to operating unit

- Remove drive unit panelling (see chapter 9.3 page: 19).
- Disconnect the battery cable connecting plug at the controller (1).
- Measure the voltage between the red (+) and black (-) cables on the battery feed. You must measure all combinations between the red (+) and black (-) cables.
  The voltage must amount to a minimum of 19 V.

Battery connector plug at controller



Test results:			**Chapter:**
Voltage < 19 V	• Battery fully discharged.	⇒ Check battery.	Chapter: 11.1 page: 31
No voltage	• Main fuse defective	⇒ Check/replace main fuse	Chapter: 10.1.5 page: 27
	• Cable defective.	⇒ Check/replace cable.	Chapter: 10.2.3 page: 29

12 Appendix

12.1 Charging of fully discharged batteries

If a voltage of less than 9.5 V is measured at a battery, the battery is fully discharged. Also observe the information on the charging of batteries contained

- in the vehicle Operating Manual
- in the charger Operating Manual
- on the charger

CAUTION:Risk of accidents!

Batteries are not allowed to lie on their sides or stand on edge while being charged.

For charging a fully discharged battery, proceed as follows:

- Remove the batteries from the vehicle.
- Pre-charge each battery individually while simultaneously measuring the charging voltage.
- Pre-charge battery up to 10 V by means of an unregulated charger.
  Then stop charging procedure.

CAUTION:Explosion hazard!

Do not fully charge batteries using an unregulated charger.

- Put batteries back into the vehicle.
- Fully charge battery using the Invacare charger via the Scooter charging socket .
  The charging procedure should last for at least 48 hours.

12.2 Connecting the programming device

12.2.1 Preparation

- Secure the Scooter against rolling away by blocking the front wheel with wedges.
- Raise the rear of the Scooter until the drive wheels can turn freely and support by blocking up the anti-tipper wheel.
  You will now be able to check drive commands because the drive wheels can turn freely.

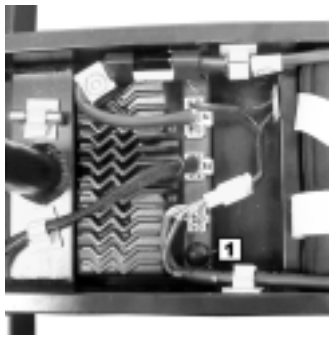
CAUTION:Danger because Scooter can roll away!

- *Secure the Scooter against rolling away by blocking the front wheel with wedges before raising.*

12.2.2 Connecting the programming device

- Switch off the Scooter.
- Remove the chassis panelling (see chapter 9.3 page: 19).
- Remove the cover cap (1) next to the remote plug on the controller.
- Plug the hand programming device connector plug into the socket.
- Switch on the Scooter.
- To program the Scooter, see the programming device operating manual.

Remove the cover cap



Note:

The connector plug also attached to the programming device for the charging socket cannot be used for programming the Scooter.

Removing the programming device

- Switch off the Scooter.
- Remove the hand programming device connector plug from the socket.
- Replace the cover cap.
- Complete the Scooter.